33. The Crustacea Decapoda of the Lake of Tiberias.[1]

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(Plates XII—XIV.)

Only three species of Crustacea Decapoda have been found in the Lake of Tiberias and its immediate vicinity, and it is most improbable that any addition will be made to this number.

Two of the three species, namely *Atyaephyra desmaresti* and *Potamon potamios*, have already been discussed by Barrois [2] in his "Liste des Décapodes fluviatiles recueillis en Syrie," while the third (*Typhlocaris galilea*), by far the most interesting of the three, was described by Dr. Calman as recently as 1909.

Atyaephyra desmaresti has a wide circum-Mediterranean distribution and also occurs in some adjacent countries not actually on this sea-board; the range of *Potamon potamios* is apparently restricted to the Jordan Valley, lower Egypt and the Island of Cyprus, while *Typhlocaris galilea* is endemic in one small pool near the shores of the lake, into which there is no evidence that it ever penetrates.

The last species is of peculiar interest both from a taxonomic and from a biological point of view, for not only is it isolated by its structural characters from all other freshwater or marine decapods, but it is apparently modified for a subterranean existence. The fact that the animal is found living in an open and well-lighted pool is, therefore, very strange. We may hazard the suggestion that the seismic movements which have undoubtedly occurred, and are still liable to occur, on the shores of the Lake of Tiberias may have brought about some change in its mode of life, and that it has been forced thereby to abandon the environment by which its special modifications were originally induced.

The light cast by the Decapoda on the origin of the fauna of the Lake of Tiberias is not a strong one. The only prawn actually found in the lake is essentially a "Mediterra-

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[1] Published by permission of the Trustees of the Indian Museum.
[2] Barrois, Rév. biol. Nord France, V, p. 125 (1892).

nean'' species, whereas the crab has a more restricted distribution and would seem to indicate an Egyptian, though not an Ethiopian, affinity. It is noteworthy, however, that, for some reason very difficult to explain, it seems to be a general rule that the distribution of freshwater crabs is more restricted than that of freshwater prawns; *Typhlocaris* is of course an exception to this rule, as it also is to others.

Family ATYIDAE.

Atyaephyra desmaresti (Millet).

1832. *Hippolyte desmarestii*, Millet, Ann. Sci. nat., XXV, p. 461, pl. x B.
1837. *Hippolyte desmarestii*, H. Milne-Edwards, Hist. nat. Crust., II, p. 376.
1843. *Caridina desmaresti*, Joly, Ann. Sci. nat., Zool., (2), XIX, p. 34, pls. iii, iv.
1849. *Caridina longirostris*, Lucas, Hist. nat. Anim. Explor. Sci. Algérie, Zool., I, p. 40, pl. iv, fig. 1.
1863. *Caridina desmarestii*, Heller, Crust. südlich. Europ., p. 238, pl. viii, fig. 3.
1866. *Atyaephyra rosiana*, Brito-Capello, Desc. esp. nov. Crust. Arachn , Lisboa, p. 6, pl. 1, fig. 1.
1868. *Caridina desmaresti*, v. Martens, Arch. f. Naturgesch., XXXIV, p. 50.
1879. *Atyaephyra rosiana*, Kingsley, Proc. Acad. Sci. Philadelphia, XXXI, p. 415.
1880. *Caridina desmaresti*, Boas, Stüd. over Decap. Slaegtsk., p. 60, pl. i, fig. 26; pl. ii, fig. 47; iii, figs. 82, 106; pl. v, figs. 151, 163.
1880. *Caridina desmarestii*, Stossich, Boll. Soc. Adriat. Sci. nat., Trieste, p. 211.
1886. *Caridina desmarestii*, Pelseneer, Bull. Mus. Belg., IV, p. 211.
1890. *Hemicaridina desmarestii*, Ortmann, Zool. Jahrb., Syst., V, p. 464.
1891. *Hemicaridina desmarestii*, Thallwitz, Abhandl. Ber. Zool. Mus. Dresden, No. 3, p. 27.
1892. *Hemicaridina desmarestii*, Barrois, Rév. biol. Nord France, V, p. 126, figs. 1-3.
1895. *Atyaephyra desmarestii*, Ortmann, Proc. Acad. Sci. Philadelphia for 1894, p. 401.
1896. *Atyaephyra desmaresti*, Picquenard, Bull. Soc. Sci. et Medic. de l'Ouest, Rennes, p. 45.
1903. *Atyaephyra desmaresti*, Bouvier, Bull. Soc. Ent. France, p. 245.
1905. *Atyaephyra desmaresti*, Bouvier, Bull. Sci. France et Belg., XXXIX, p. 67.

1905. *Atyaephyra desmarestii*, Brözek, Sitz-ber. Böhm. Ges. Wiss., Prag, No. i, p. 1.

1905. *Atyaephyra desmarestii*, Chaignon, Bull. Soc. Autun, XVII, p. 80.

This little prawn is represented in the collection before us by numerous specimens, which do not, so far as one is able to judge from published descriptions, differ in any constant character from European examples. Most of our specimens are small, the largest being a non-ovigerous female 24·5 mm. in length; the largest ovigerous female is only 19 mm. long and some are considerably smaller. The formula of the rostral teeth varies considerably, the extremes being represented by the following figures $\frac{17\text{-}26}{3\ 7}$. To some extent, however, variation in this respect is due to size and therefore, probably, to age, for very small individuals always have a small number of teeth both above and below. Of the dorsal teeth, from 1 to 4 are situated on the carapace behind the orbital notch; as a rule, only 2 or 3 occur in this position, the number being rather lower than that usually found.

The size of the eggs is another variable character. In one female eyed eggs were 627 μ long by 443 μ in greatest transverse diameter; in another in which they were in a somewhat more advanced stage of development, the corresponding measurements were 596 μ and 394 μ; in all cases they had a very regular oval contour.

Living individuals were sometimes hyaline and practically colourless, having only a few scattered pigment-cells on the body and appendages; others were so deeply pigmented as to be almost black, while yet others had their pigment distributed in regular transverse stripes of a blackish colour on the thorax, abdomen and limbs. A few were noticed in which the muscles of the body had a distinct yellow tinge and were much less transparent than usual. Although no very small individuals were seen which were deeply pigmented, some ovigerous females were found to be practically colourless, except that the eggs had a deep green colour. The one male examined was hyaline.

Among the numerous individuals taken in October, 1912, in the neighbourhood of the Lake of Tiberias, we have found only this one male. From a careful examination of its appendages and of those of several females, we are able to confirm Barrois's statement as to the sexual differences that exist in the third and fourth legs of this species. His figures agree well with our own observations.

Egg-bearing females were not common in October and it is rendered probable that the breeding season was then practically over by the fact that most of the eggs observed were in an

advanced state of development and that most of the females had apparently hatched their brood.

The larva of *Atyaephyra* was described by Joly in 1843 (*loc. cit.*) and we have little to add to his observations, which are fully illustrated by good figures. Indeed, larvae from the neighbourhood of Tiberias agree with these in every respect, except that their tails are more distinctly bilobed and that their rostra are more delicate and less prominent. He gives an excellent description of the appendages, which closely resemble those of the larvae of *Caridina wyckii* (=*nilotica*) as described by Von Daday [1] and of *Xiphocaridina compressa* as described by Ishikawa.[2] The Tanganyika Atyid larvae described by G. O. Sars [3] and attributed by him with a query to the genera *Limnocaridina* and *Atyella* are apparently hatched at a somewhat earlier stage.

Atyaephyra desmaresti occurs all round the Mediterranean, in N. Africa as well as in Europe. It has been recorded from Portugal and appears to be widely distributed in France, but is not included by Keilhack [4] among the German freshwater Malacostraca.

In the Lake of Tiberias it is scarce. Barrois [5], however, obtained a few specimens from a depth of 5 to 8 metres at the south end, probably in the channel of the River Jordan in which there are submerged beds of *Vallisneria*. In the immediate vicinity of the lake it is, as Barrois states, extremely abundant in the Jordan among beds of waterweeds, both to the north and to the south. It was also found in large numbers in pools in the limestone at Ain-et-Tineh and in the stream that runs through the Wad-es-Semakh. In the last situation it occurred among the roots of shrubs growing on the banks, while in the others it was only noticed among waterweeds, especially, but not exclusively, *Ranunculus aquatilis*.

Joly states that the chief food of *Atyaephyra* consists of Entomostraca and filamentous algae and that it frequently devours the putrefying dead of its own species. Except as regards the Entomostraca, we have observed similar habits in *Caridina nilotica*, which, however, also feeds largely on unicellular algae obtained by brushing up debris with the peculiar setae on the chelae of the first and second peraeopods. Apparently one or other of the mouth-parts has the power of rejecting unsuitable substances that come in contact with them.

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[1] Von Daday, Zool. Jahrb. Anat., XXIV, p. 239 (1907).

[2] Chiyomatsu Ishikawa, Quart. Journ. Micr. Sci., XXV, p. 391 1885).

[3] Sars, Proc. Zool. Soc., London, I, p. 426, pls. lvii, lviii (1912).

[4] Keilhack, in Brauer's Susswasserfauna Deutschlands, XI, Malacostraca, etc. (1909).

[5] Rév. biol Nord France, VI, pp. 280, 281 (1894).

Family PALAEMONIDAE.

Subfamily TYPHLOCARIDINAE.

Typhlocaris galilea, Calman.

(Plates XII, XIII.)

1909. *Typhlocaris galilea*, Calman, Trans. Linn. Soc., Zool (2), XI, p. 93, pl. xix.

In describing *Typhlocaris*, Dr. Calman has suggested that this peculiar genus should perhaps be regarded as the type of a distinct subfamily of the Palaemonidae, and with this view we are in entire agreement. The differential characters of the Typhlocaridinae may be briefly stated as follows:—

1. The small and feebly developed rostrum.
2. The palpless mandible.
3. The rudimentary condition of the additional ramus of the outer antennular flagellum.
4. The undivided distal endite of the maxilla.
5. The presence of a pair of longitudinal suture lines on the carapace, recalling those found in certain Reptantia and Penaeidae.

In the first of these characters the subfamily agrees with some Pontoniinae and Palaemoninae; in the second with all members of that subfamily and with some Palaemoninae; in the third with the Palaemoninae more than any other subfamily. In the fourth and fifth characters *Typhlocaris* differs, so far as is known, from all other Palaemonidae.

As Dr. Calman has pointed out, *Typhlocaris* bears in certain respects, notably in the reduced rostrum, the broad telson and uropods and apparently in its general facies, a close resemblance to the peculiar S. American Palaemoninae of the genus *Euryrhynchus*. It is unfortunate that the first maxilla in that genus has not been described, but there is certainly no trace on the thorax of the "linea thalassinica." Moreover, there are other important distinctions between the two genera, especially in the structure of the outer antennular flagellum, and we are inclined to regard the resemblance between them as convergent rather than of genetic origin.

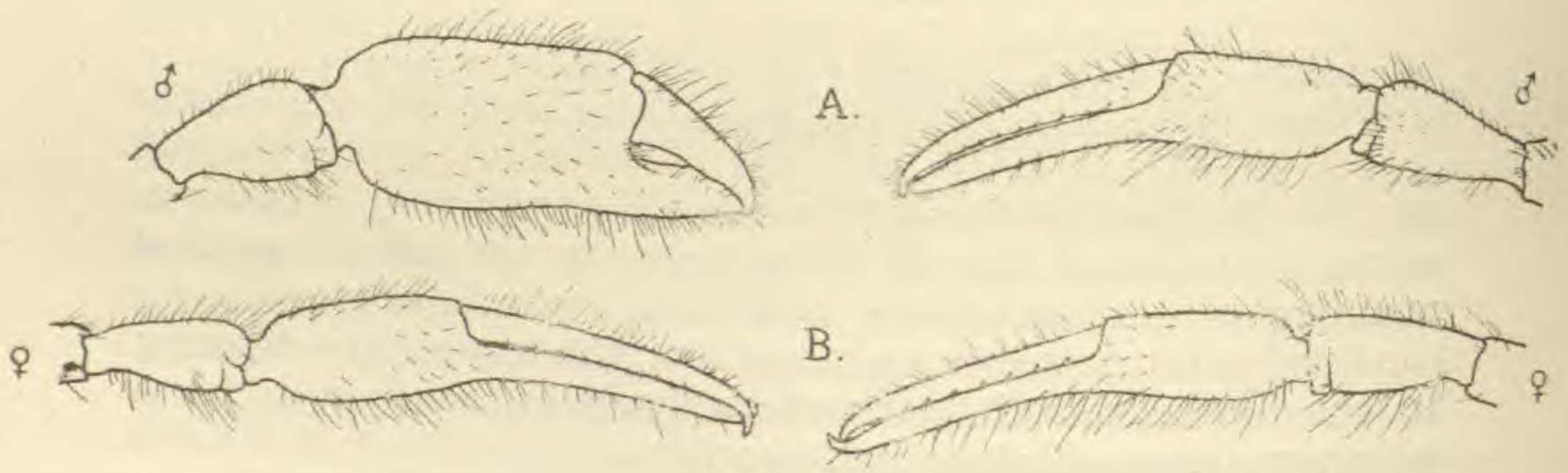
It is difficult to say in all cases what are the functions of the common characteristics, but it is noteworthy that those genera of Pontoniinae (*Pontonia*, *Conchodytes* and *Typton*), in which the rostrum is reduced, are, at any rate in most cases, of semi-parasitic or symbiotic habits and live in enclosed spaces. Nothing is known of the mode of life of the two species of *Euryrhynchus* yet described, except that they have been found in wells, into which it is probable that they have made their way from some subterranean reservoir. *Typhlocaris galilea*, as

is shown below, moves about freely in an open but well-like pool fed by a subterranean spring and not in direct communication with any large mass of water above ground. It is probable therefore that *Euryrhynchus* resembles it in bionomics.

Dr. Calman's excellent account of the species leaves little to be said as regards its external characters, while Mr. Ekendranath Ghosh has, in the preceding paper of this series, described its internal anatomy in detail.

The specimens before us indicate that the second peraeopod of the male mentioned by Calman, in which the immovable finger is shorter than the dactylus, is, as he suggests, abnormal; but our specimens also show that there is normally a very marked dissimilarity between the two large chelae of the male (fig. A).

In the female the two are similar in form, though not always equal (fig. B) and agree with Calman's fig. 11, except that they are a little more slender and longer. In the leg of this



type the carpus is only a little shorter than the palm; the palm itself is almost cylindrical and the fingers, which are similar in outline, are slender and of about one and a half times its length.

In the male (fig. A) one chela is normally of this type, though slightly stouter and not so long; while the other is strikingly different. The carpus is a little more swollen distally and not much more than half as long as the palm. The palm is distinctly flattened and its breadth is to its thickness as $10\frac{1}{2}$ to 7. The fingers are very much shorter and stouter than in the other claw. The dactylus is only about two-thirds the length of the palm; it has no cutting edge, but is feebly grooved internally, both margins being definitely sinuous in lateral view; there is no process sufficiently distinct to be called a tooth. The immobile finger is a little shorter than the dactylus and resembles it in form except that the internal groove is obsolete. The limbs of both types are set with coarse setae.

Dr. Calman has kindly sent us a sketch of the claws of a male specimen recently seen by him in which the same

secondary sexual character is apparent. We have ourselves examined four males and three females.

The colour in life is of a uniform dead white, neither opaque nor transparent but rather translucent, resembling that of paraffin wax or, more accurately, that of the opalescent glass of which lamp-shades are often made. There is no trace of external pigmentation; the partial opacity is inherent in the muscles, the integument being perfectly transparent. The stomach and the liver can be detected externally as dark irregular masses.

The minute hairs on the thorax are more conspicuous in the living animal than they are in specimens in spirit, as they stand upright and are as a rule covered with minute debris (pl. XII, fig. 1). They do not, however, collect sufficient dead matter to aid in concealing the animal, which is a most conspicuous object in its natural surroundings.

So far as it is possible to ascertain from the most careful enquiries on the spot, *Typhlocaris* is only found in the octagonal pool at et-Tabghah called Birket 'Ali-ed-Dhaher, in which it has long been known to the Bedouins of the district as العقرب لا بيضى or "white scorpion." The pool (pl. XIII) has recently been described in this Journal and the water analysed[1]; all that we need say here is that it is a small artificial pool containing from six to ten feet of brackish and sulphurous water and about 58 metres in circumference; that it now has no direct communication with the Lake of Tiberias, close to the shore of which it is situated, but that a connection of a sort, perhaps artificial, existed in historic times. It must be fed by a subterranean spring or springs, but the point of entry of these has not been investigated. In October, 1913, the surface was almost entirely concealed by the growth of a gigantic grass, which was rooted at the edge, but sent out long floating stems. No other phanerogamic water-plants occurred and the fauna, probably owing to the composition of the water, was much poorer than that of fresher pools in the neighbourhood. Only one species of fish (*Discognathus lamta rufus*, Heckel) and two of Mollusca[2] (*Bithinella* spp. nov.) were seen and no examples of *Atyaephyra* could be discovered, notwithstanding a very careful examination of the floating grass.

In its movements *Typhlocaris* closely resembles *Palaemon*, but is rather more sluggish than any Indian species of that genus with which we are acquainted. As a rule it progresses on the bottom, partly by means of its walking legs and partly by the use of its swimmerets, the abdomen being raised higher than the thorax in order to give the latter free play. The first peraeopods are used to a slight extent in locomotion, but their

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[1] Christie, Journ. As. Soc. Bengal, 1913, p. 25.
[2] For this determination we are indebted to Mr. H. B. Preston.

chief functions are to clean the other appendages, including the swimmerets, and to convey food to the mouth. Occasionally the animal moves forwards through the water by means of the swimmerets alone, the fore parts then being raised higher than the abdomen. It was not, however, observed to approach the surface. *Typhlocaris* can also dart rapidly backwards when alarmed, but does not do so rapidly or with such force as many species of *Palaemon*. The manœuvre is executed in the usual manner, that is to say by suddenly bending the telson towards the base of the thorax.

So long as the prawn is moving either backwards or forwards, the claws are held with the basal segments projecting out from the body almost at right angles, but with the carpus and chela directed forwards. They have the appearance of protecting the anterior part of the body and to some extent feeling the way. The chief part in testing the surface in forward progression is, however, played by the outer maxillipeds (pl. XII, fig. 2), with which *Typhlocaris* constantly taps the ground, as does *Palaemon*. The antenna is, as a rule, held directed outwards and often considerably upwards, while the rami of the antennules are spread out so as to cover as large an area as possible. At periods, when the animal is at rest, they are held still, but, as a rule, they are in frequent motion. It was observed that a movement in the water near the prawn sometimes, but not always, caused it to dart away.

Typhlocaris is evidently timid in disposition and, unless engaged in feeding, moves away when it is approached by a crab or fish, although no direct evidence is forthcoming that either *Potamon* or *Discognathus* attacks it. Several of the specimens obtained, however, have lost and were regenerating various limbs.

It was found possible to attract the prawns in considerable number from their hiding places by throwing into the pool chicken and pigeon bones. The bones were seized by the chelae, pieces of meat were torn from them and conveyed to the mouth by the first peraeopods, or they were carried away bodily under stones, notwithstanding the efforts of large numbers of *Discognathus* which were also nibbling at them. Little notice was taken of half a dead *Discognathus* let down on a string beside a prawn; but the prawn seized the string with its chelae and gave it a violent tug. While moving on the bottom of the pool, which is composed of fine mud, and on the stones of which the walls are built, *Typhlocaris* was often observed to pick up small objects by means of its first peraeopods and devour them; but their nature was not detected.

No observations were made which cast any light on the functions of the sutures in the carapace; but we may note that the carapace fits tightly round the bases of the legs and thus probably assists in respiration by keeping mud from entering

the gill-chamber. As Dr. Calman has pointed out, the margins of the carapace are membranous; this feature, combined with the horizontal hinge, may well be useful in the direction indicated.

No direct evidence could be obtained that *Typhlocaris* is subterranean in habits: it is certainly not exclusively nocturnal. As nothing is known of the structure of the pool in which the animal lives, it is impossible to say whether it can retire underground; it may do so periodically to breed or for other purposes, and one of the monks who live at et-Tabghah on one occasion searched for specimens for some months without being able to obtain them. No details, however, are available as to the methods he adopted. No specimens were seen by Annandale on a visit paid to the pool early in the morning, although several were observed and captured later on in the same day.

In most cases the prawns were first seen emerging, at all hours between 10 A. M. and dusk, from under stones lying on the bottom or forming part of the walls. They frequently wandered under other stones and sometimes emerged again at a considerable distance from the place at which they entered. Several were observed actually at noon, but none were seen in bright sunlight, which never, at any rate in October, reached the part of the pool in which they lived. The removal of the floating grass from the surface apparently made no difference in their movements and they showed no inclination to avoid the fairly strong light that reached and shone through the clear water practically without obstruction. An individual living in an aquarium did not even move away when a lamp was placed close to the glass against which it rested, although the lamp was left in the same position for half an hour.

Typhlocaris, therefore, is evidently not negatively heliotropic, although no evidence could be obtained that it is, either under natural conditions or in captivity, positively so.

None of the specimens obtained were actually breeding at the time they were killed, but the condition of their gonads would suggest that the breeding season was approaching.

The photographs reproduced on plate XII were taken at Tiberias by the Rev. J. Cohen of that town under the supervision of one of us. We have to thank him for his courteous assistance in the matter.

Family POTAMONIDAE.

Potamon (Potamon) potamios (Olivier), Rathbun.

(Plate XIV, fig. 1).

?1804. *Cancer potamios*, Olivier (*partim*), Voy. Empir. Oth., IV, p. 240, atlas, pt. 2, pl. xxx, fig. 2.

1893. *Telphusa fluviatilis*, Barrois, Rév. biol. Nord France, V, p. 125.
1904. *Potamon potamios*, Rathbun, Mem. Mus. Hist. Nat. (Paris), (4), VI, p. 257.

We follow Miss Rathbun in calling the common crab of the Jordan Valley *Potamon potamios*, but in so doing are of the opinion that it is doubtful whether this form was included in the composite group to which Olivier in 1804 gave the name of *Cancer potamios*. The species, or group, was founded to include crabs from Naxos, Syria, Mesopotamia and Persia, an area from which at least two allied forms are known and in which the crab accepted by Miss Rathbun as *Potamon potamios* probably does not occur. The term 'Syria' is often used somewhat loosely; but Olivier himself in his atlas (*loc. cit.*, pl. xxii) distinguished Syria from Palestine, and his journey hardly extended into the latter country. We have no reason to think that the species, as defined by Miss Rathbun, has been found within the limits of Syria proper, for Djerach, the only 'Syrian' locality from which *P. potamios* is definitely recorded, lies near the R. Jabbok in Eastern Palestine considerably south of the Lake of Tiberias. Both Miss Rathbun (*loc. cit.*) and Col. Alcock[1] have, however, accepted the Palestine crab as the type of its genus, and any proposal to alter the name would now only lead to confusion and would, in any case, be based merely on a study of probabilities.

As the group to which *P. potamios* belongs has given rise to considerable confusion, apart from nomenclature, owing to the extremely close relationships of its members, we take this opportunity to discuss it in some detail, having good series of specimens of most of the forms before us.

The group, as we conceive it, consists of only two species, *Potamon potamios* (Olivier), Rathbun, and *P. fluviatile* (or *edule*) (Latreille), the latter being divided into five local races: *fluviatile* (*s. s.*); *setiger*, Rathbun; *ibericum*, Marschall de Bieberstein; *gedrosianum*, Alcock, and *monticola*, Wood-Mason. The only one of these forms of which we have not seen specimens is *setiger*. The types of *gedrosianum* and *monticola* are in the Indian Museum, but we have some doubts as to the status of the latter and consider it possible that, under this name Alcock has included two distinct races. In any case the number of specimens known is so small that it would hardly be profitable for us to discuss the question. We have, therefore, omitted *monticola* from the following key, but have figured one of the types and also the only specimen from the Khasi Hills in plate XIV, figs. 6 and 5, respectively. It will be noticed in these figures that the eyes are considerably larger and stouter than in *P. potamios* or in any of the western races of *P. fluviatile*.

[1] Rec. Ind. Mus., V, p. 258 (1910).

KEY TO THE CRABS OF THE *Potamon potamios* GROUP.

I. Epigastric crests only a little in advance of post-orbitals and parallel to them; post-orbitals running in a straight line at right angles to the long axis of the carapace, hardly interrupted or angulate at anterior end of cervical groove *P. potamios.*

II. Epigastric crests usually well in advance of post-orbitals and sloping towards them; post-orbitals sinuous, convex forwards or slanting, distinctly interrupted and angulate at anterior end of cervical groove .. .. *P. fluviatile, s.l.*

Races of *P. fluviatile.*

A. Length of carapace nearly seven-eighths its breadth; propodus of last leg less than twice as long as broad .. .. .. *fluviatile.*

B. Length of carapace usually less than five-sixths its breadth; propodus of last leg usually at least twice as long as broad.

1. Carapace setose .. .. .. *setiger.*
2. Carapace not setose

a. Middle portion of cervical groove on either side obsolete, anterior part not very sharply defined; epigastric crests more in advance of post-orbital crests .. *ibericum.*

b. Cervical groove distinct throughout its length, forming a well-defined sulcus at its anterior extremity; epigastric crests less in advance of post-orbital crests .. *gedrosianum.*

So far as we are able to judge from the descriptions given by Miss Rathbun [1] and Dr. Pesta [2], we are doubtful whether *P. fluviatile setiger* is more than a phase of *P. fluviatile ibericum*; it seems to differ from that race in no character except the presence of short hairs on the carapace, a feature which is of little specific value in certain other Decapod crustaceans, *e.g. Hippolyte varians* form *fascigera.* Dr. Pesta, moreover, states that the hairs are frequently worn away and we can detect small pits, such as those from which setae might be expected to arise, on the carapace of many specimens of the races *ibericum* and *gedrosianum.* For the present, we prefer to leave the precise status of the form doubtful. We cannot, however, accept it as a distinct species.

Alcock has dealt in his comprehensive monograph of the Indian Potamonidae very fully with the differences between *gedrosianum* and *ibericum* [3], which are much more nearly related to one another than either is to the typical European race of *P. fluviatile.* We have taken measurements of the larger specimens in the collection of the Indian Museum and give them in an appendix. They may be summarised as follows:—

[1] Mem. Mus. Hist. Nat., Pars (4), VI, p. 258. text-fig. 3, pl. ix, fig. 2.
[2] Ann. k. k. naturhist. Hofmus., Vienna, XXVII, p. 27. text-fig. 12. 1913.
[3] Cat. Ind. Decap., Crust. I, fasc. 2, Potamonidae, pp. 21-23, figs. 1, 37. 1910.

	Carapace, length ÷ breadth, × 100.			Propodus of 5th leg, breadth ÷ length × 100.			No. of specimens.
	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	
Potamon potamios ..	79·4	**80·1**	82·1	44 1	**51·6**	55·0	7
,, *fluviatile fluviatile*..	86·0	**87·0**	88·1	43·2	**46·1**	49·2	6
,, ,, *ibericum* ..	78·2	**81·7**	86·0	48·8	**53·4**	59·0	18
,, ,, *gedrosianum*	75·4	**81·9**	84·3	46 5	**53·5**	58·4	16

From this table it would seem that in their proportions, *P. fluviatile ibericum* and *gedrosianum* resemble *P. potamios* more closely than they do *P. fluviatile fluviatile*; but the importance of this fact is minimised by the differences in the form of the post-orbital and epigastric crests, a character which we consider of more weight than those derived from measurements. We follow Alcock, therefore, in regarding the two forms as races of *P. fluviatile* rather than of *P. potamios*.

Potamon potamios is the common freshwater crab of Lower Egypt and of the valleys of the Jordan and its tributaries; it has also been found in Cyprus, which lies not very far from the coast of Palestine.

Potamon fluviatile has, as a species, a wider range, extending through Italy and Greece into Turkey, the Archipelago, Asia Minor, Northern Syria, Mesopotamia, the districts round the Black Sea and the Caspian, Persia, North-West India and possibly the Eastern Himalayas and the Khasi Hills in Assam. In Northern Africa it is found in Morocco, Algiers and Tunis, penetrating inland to the Sahara.

The distribution of its local races is as follows :—

Race *fluviatile*,

Italy, Greece, Morocco, Algiers, Tunis, the Sahara.

Race *ibericum*,

The Crimea, the Caspian Sea, Asia Minor, Northern Syria, Persia, Afghanistan and the Jhelum Valley in N. W. India.

Race *setiger*,

Northern Syria, Mesopotamia.

Race *gedrosianum*,

Seistan, Baluchistan, Peshawar and the Punjab Salt Range.

Race (?) *monticola*,

Eastern Himalayas and (?) the Khasi Hills, Assam.

Potamon potamios is extremely common round the edge of the Lake of Tiberias and the neighbouring springs, inhabiting burrows just above the water-line and thence wandering both into the water and on to dry land in search of food. As soon as the first rains of the winter season fall (in 1912 this was on October 16th), its landward expeditions are greatly extended. Near Tiberias, after rain had fallen, it was noticed in considerable numbers on the road round the lake, and several large individuals were seen that had been crushed by the feet of passing animals. The food is evidently of a very varied nature. Large individuals were observed eating dead fish in the lake; others were attracted to (and captured by) a piece of tomato attached to a string; a chicken-bone thrown into the spring at Ain-et-Tineh was seized and carried away bodily by a crab that appeared to issue from under a rock before the bone had touched the water; half-grown individuals were watched running after, seizing in their claws and devouring, large black ants[1] in the highway.

At least three years must elapse before the full size is reached. The smallest specimen obtained in October measures 9·5 mm. in breadth and none appreciably smaller were seen. One probably something over one year old measures about 14 mm. across the carapace, while the great majority of specimens measure from 30 to 40 mm. Large individuals are comparatively scarce; the largest in the collection of the Indian Museum measures 61 mm. in breadth, but some that were seen in the lake were probably larger. The breeding season is apparently in winter. In October a pair were seen evidently just about to couple, but separated on being touched. The female lay on her back in the water and the male clasped her with his walking legs.

The dorsal surface of small and half-grown individuals examined in a living condition in Galilee was of a dull and almost uniform olive green, only the tips of the claws and feet being paler. Two types of colouration were, however, observed among large males and females, and in this respect no difference between the sexes was apparent. In one type a purple, and in another an olivaceous yellow predominated. In the former

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[1] The large workers of *Camponotus maculatus thoracicus*, Fabr., var. *fellah*, Emery. We have to thank Prof. W. M. Wheeler for identifying specimens.

the carapace was dull purple, fading to violet at the margin and on the limbs; the tips of the claws and legs were bright orange and the ventral surface was of a pale neutral shade tinged with violet. In the second type the dorsal surface was of a bright olivaceous yellow-brown, fading to a distinct yellow at the tips of the limbs, and the ventral surface was pale without a trace of violet. Purple individuals seemed to be more numerous at the end of October than at the beginning of the month, and both of the pair found together belonged to this type. It is possible that the purple colouration, which is confined to fully mature individuals of both sexes, is periodical, only being adopted at the approach of the breeding season.

Note on the Pool inhabited by *Typhlocaris*.

One of us has recently received the following note from the Rev. S. H. Semple of Tiberias. It is dated July 12th, 1913.

"The doubt as to the source of the abundant water-supply for the old mills at Tabighah you can lay to rest. It is no other than the octagonal fountain, which since your visit has changed ownership and been thoroughly cleared of the "grasses" you mention [J.A.S.B., IX, p. 28]. The jungle outside has likewise disappeared, and it is at once seen that the water makes its way through a break, low down, in the masonry and almost directly underneath the two circular openings [pl. xiii, fig. 3 B]. There are two "heads" to the spring, and it is now ascertained that the water is more than three metres deep where formerly the grasses grew so luxuriantly. (Compare with this the "two feet" of Thomson's "Land and Book," Vol II, p. 414)."

Although this proves that water flows from the pool into the lake, the intervention of water-mills would render migrations from one to the other on the part of *Typhlocaris* practically impossible. It is to be hoped that the cleaning of the pool has not exterminated the prawn.

APPENDIX.

Measurement of crabs of the *Potamon potamios* group.

		Carapace.			Propodus of 5th peraeopod.		
		Length.	Breadth.	Length ÷ breadth × 100.	Length.	Breadth.	Breadth ÷ length × 100.
P. potamios—							
L. of Tiberias, $\frac{8311}{10}$ ..	♂	42·1	53·0	79·4	13·25	6·6	49·8
	♀	35·3	44·2	79·9	11·6	5·75	49·6
	♀	33·2	41·75	79·5	10·1	5·55	55·0
	♂	30·7	38·2	80·0	9·65	5·3	54·9
	♂	28·4	35·3	80·5	9·25	4·95	53·5
	♀	27·0	34·0	79·4	8·7	4·7	54·0
Syria, $\frac{3402}{9}$	♂	50·4	61·4	82·1	16·55	7·3	44·1
P. fluviatile fluviatile—							
Florence, $\frac{4054}{4}$ ..	♂	46·4	53·2	87·2	14·9	6·8	45·6
	♂	45·2	52·1	86·8	14·6	6·3	43·2
	♂	43·5	50·1	86·8	13·2	6·5	49·2
	♂	42·8	48·6	88·1	13·7	6·25	45·6
	♂	42·5	49·4	86·0	13·4	6·3	47·0
	♀	39·9	46·8	85·3	—	—	—
P. fluviatile ibericum—							
Teheran, $\frac{4178}{4}$ ..	♂	42·6	51·0	83·5	12·8	6·6	51·6
	♀	38·6	48·75	79·2	12 5	6·1	48·8
	♂	31·7	39·3	80·7	9·8	5·15	52·6
	♀	31·6	38·3	82·5	9·6	5·2	54·2
Shiraz, $\frac{4025}{4}$ ..	♀	44·5	54·0	82·4	12·4	6·5	52·4
	♀	39·9	50·1	79·6	11·5	6·2	53·9
	♀	35·5	44·6	79·6	10·5	5·45	51·9

		Carapace.			Propodus of 5th peraeopod.		
		Length.	Breadth.	Length ÷ breadth × 100.	Length.	Breadth.	Breadth ÷ length × 100.
P. fluviatile ibericum—							
Syria, $\frac{1616\text{–}8}{10}$ ..	♀	36·75	43·3	84·9	10·5	5 7	54·3
	♀	32·5	38 1	85 3	9·9	4·95	50·0
	♂	31·6	36·75	86·0	9·5	4·9	51·6
Afghanistan, $\frac{4028}{4}$ ..	♀	28·5	34·5	82·6	8·2	5·0	60·9
	♀	27·9	33·6	83·0	—	—	—
	♀	27·6	33·2	83·1	7·5	4·3	57·3
	♀	26·7	32·2	82·9	7·8	4·6	59·0
Afghanistan, $\frac{5463}{10}$ ..	♀	30·9	37·6	82·2	—	—	—
Jhelum, $\frac{5521}{10}$ ..	♀	34·65	42·8	81·0	10·03	5·5	54·8
	♀	25·6	32·75	78·2	7·6	4·3	56·6
Transcaspia, $\frac{7063}{9}$ ..	♀	38·7	48·0	80·6	12·25	6·3	51·4
P. fluviatile gedrosianum—							
Seistan, $\frac{5015}{10}$ ..	♂	47·2	56·9	83 0	15 7	8·15	51·9
	♀	39·75	48·1	82·6	11·8	6 2	52·5
	♂	38·9	47·3	82·2	13·05	6·85	52·5
Seistan, $\frac{5554}{10}$ ..	♀	43·8	55·3	79·2	12 85	7·5	58 4
Quetta, $\frac{4655\text{–}8}{10}$ ..	♂	48·9	58·4	83·7	15·5	8 05	51·9
	♂	42·5	51·9	81·9	—	—	—
Peshin Valley, Baluchistan, $\frac{5550}{10}$ ..	♀	32·0	38·55	83·0	9·25	5·25	56·8
	♂*	52·8	64·25	82·2	15·7	8·1	51·6
	♀*	45·5	54·7	83·2	13·15	7·1	54·0
	♀	37·35	44·6	83·7	9·2	5·0	54·3
	♀	34·4	40·8	84·3	10·25	5·75	56·1

* Types of the race.

		Carapace.			Propodus of 5th peraeopod.		
		Length.	Breadth.	Length ÷ breadth × 100.	Length.	Breadth.	Breadth ÷ length × 100.
P. fluviatile gedrosianum—							
Peshin Valley, Baluchistan, $\frac{5550}{10}$ ..	♂	31·6	37·75	83·7	9·3	5·25	56·5
	♂	29·15	35·1	83·0	8·8	5·0	56·7
Salt Range, Punjab, $\frac{6416}{3}$	♀	35·0	46·2	75·8	8·3	4·3	51·8
Peshawur, $\frac{5527}{10}$ ..	♂	38·4	48·3	82·9	11·7	5·9	50·4
Hallur Hahar, $\frac{6996}{3}$ ..	♂	25·85	34·3	75·4	9·25	4·3	46·5
P. fluviatile monticola—							
Darjiling, $\frac{3032}{4}$ ..	♂*	18·65	24·05	77·5	6·85	3·35	48·9
	♀*	17·0	20·9	81·3	5·5	2 8	50·9
	♀*	16·85	21·4	78·7	6·3	2·9	44·4
Khasi Hills, $\frac{4017}{4}$ ..	♂	20·6	27·35	75·3	—	—	—

* Types of the race.

EXPLANATION OF PLATES.

Plate XII.

Adult female of *Typhlocaris galilea* (Regd. no. $\frac{8312}{10}$) photographed from life. Slightly enlarged.

Plate XIII.

The pool, Birket 'Ali-ed-Dhaber, in which *Typhlocaris galilea* is found.

Fig. 1.—The surface of the pool overgrown with grass.

,, 2.—The same, from a slightly different point of view, after being cleared.

,, 3.—The ancient outlet of the pool and the steps leading down to the platform that juts out into the water.

A = the highest water-level of the pool at present;
B = the ancient outflow.

Plate XIV.

The carapaces of *Potamon* (*Potamon*) *potamios* and its allies.

Fig. 1.—*Potamon potamios* (Olivier), Rathbun, from Tiberias, Palestine (Regd. no. $\frac{8311}{10}$). Nat. size.

,, 2.—*Potamon fluviatile fluviatile* (Latreille) from Florence, Italy (Regd. no. $\frac{4054}{4}$). Nat. size.

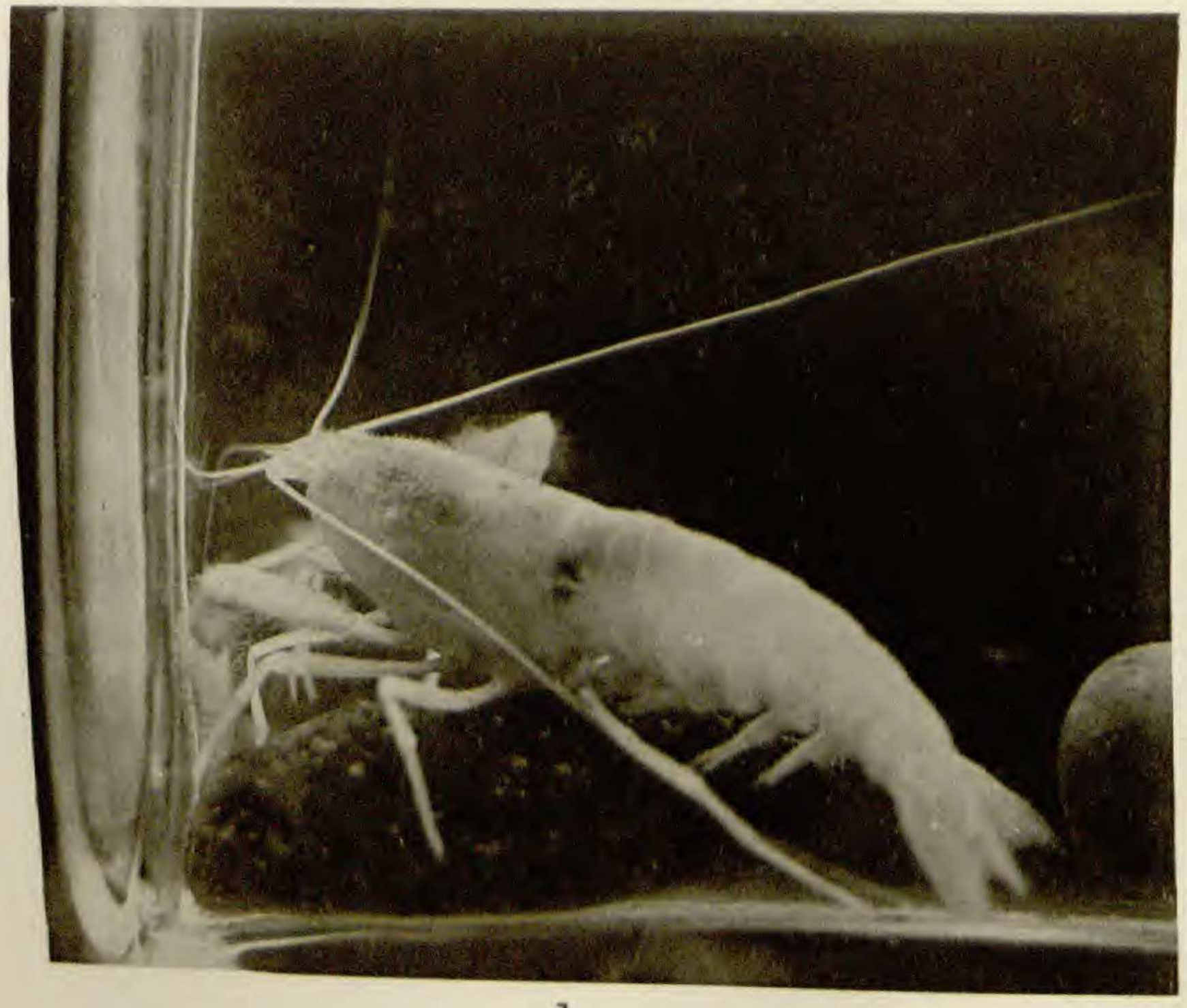
,, 3.—*Potamon fluviatile ibericum* (Marsch. Bieb.) from near Shiraz, Persia (Regd. no. $\frac{4025}{4}$). Slightly reduced.

,, 4.—*Potamon fluviatile gedrosianum*, Alcock, from the Peshin Valley, Baluchistan (♂ type, Regd. no. $\frac{5550}{10}$). Slightly reduced.

,, 5.—*Potamon fluviatile monticola* (Wood-Mason) from the Khasi Hills, Assam (Regd. no. $\frac{4017}{4}$). Enlarged.

,, 6.—*Potamon fluviatile monticola* (Wood-Mason) from Darjiling (♂ type, regd. no. $\frac{4032}{4}$). Enlarged.

Note.—All the specimens figured are adult or apparently adult males.



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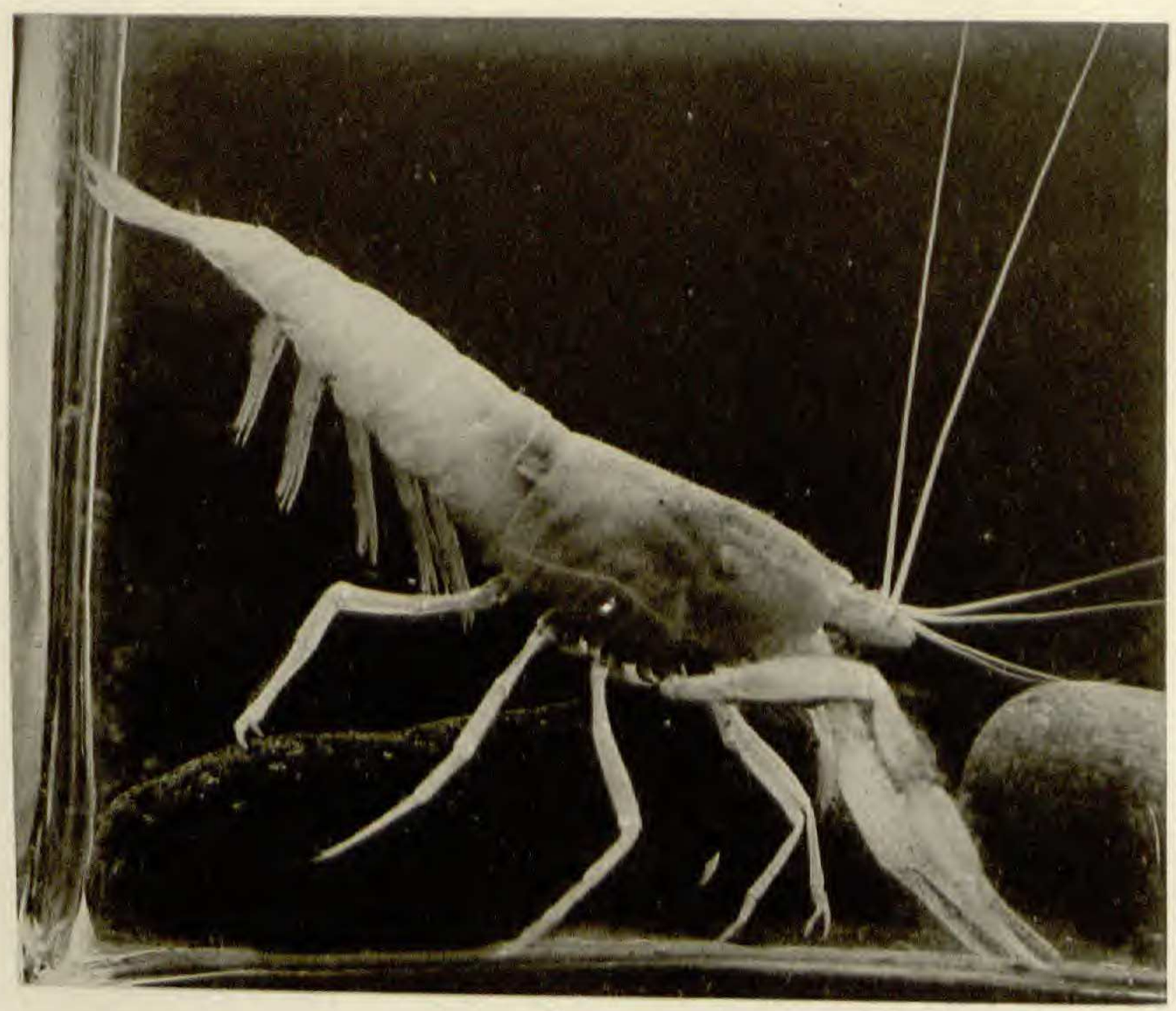
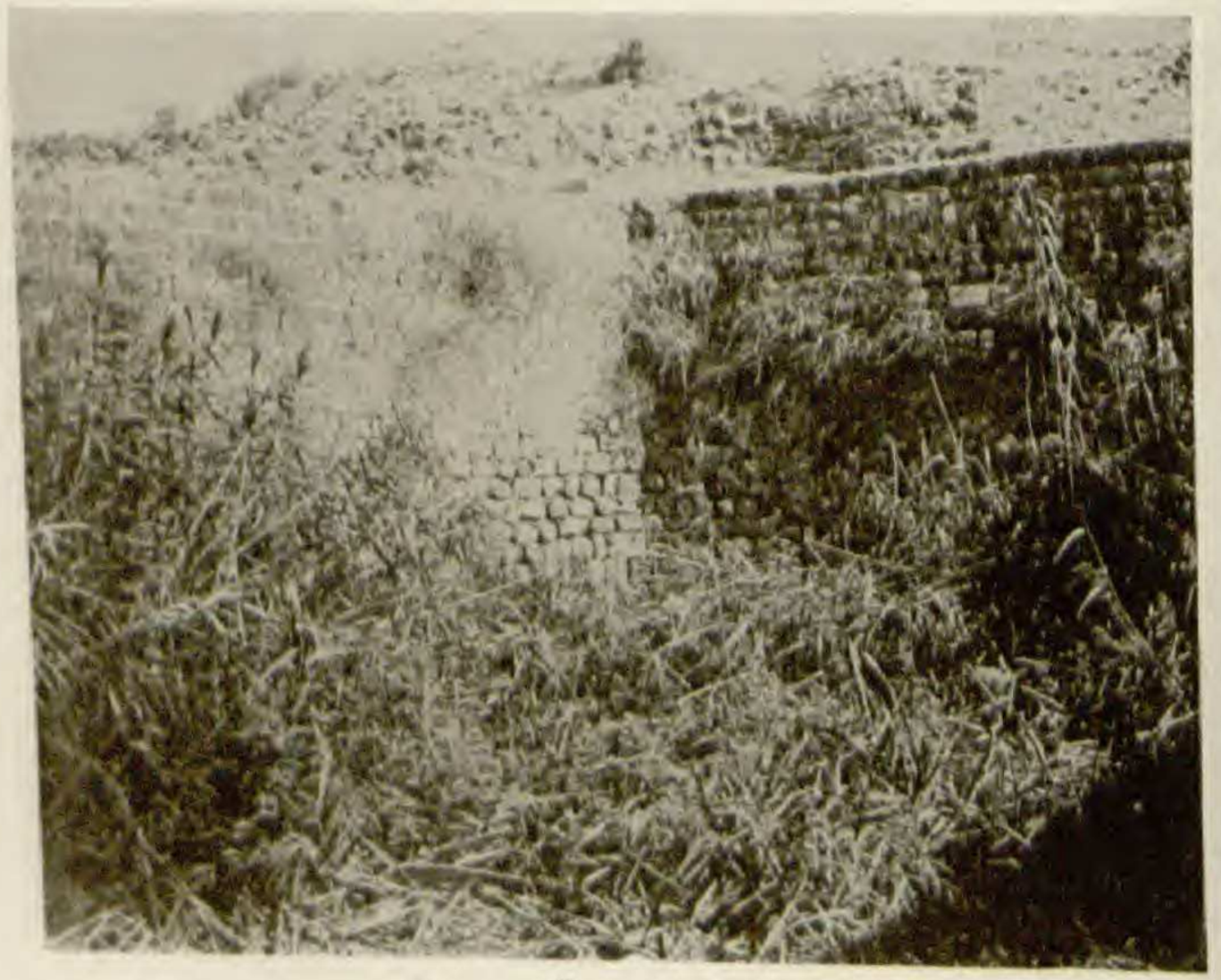


2.

Rev. J. Cohen, Photo.

THE BLIND PRAWN OF GALILEE—(TYPHLOCARIS GALILEA, CALMAN).

Bemrose, Collo., Derby.



1.

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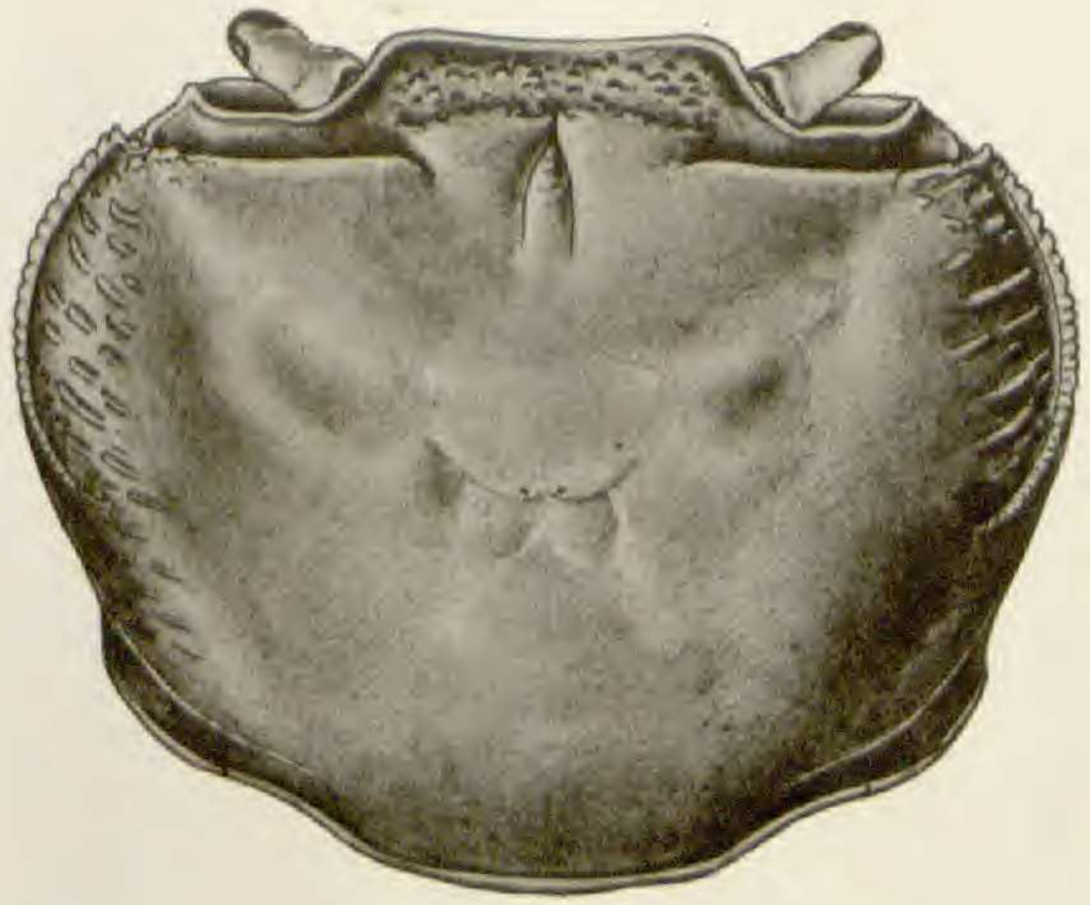
N.A. Photo.

BIRKET 'ALI-ED-DHAHER, THE HABITAT OF TYPHLOCARIS GALILEA, CALMAN.

Bemrose, Colla., Derby.



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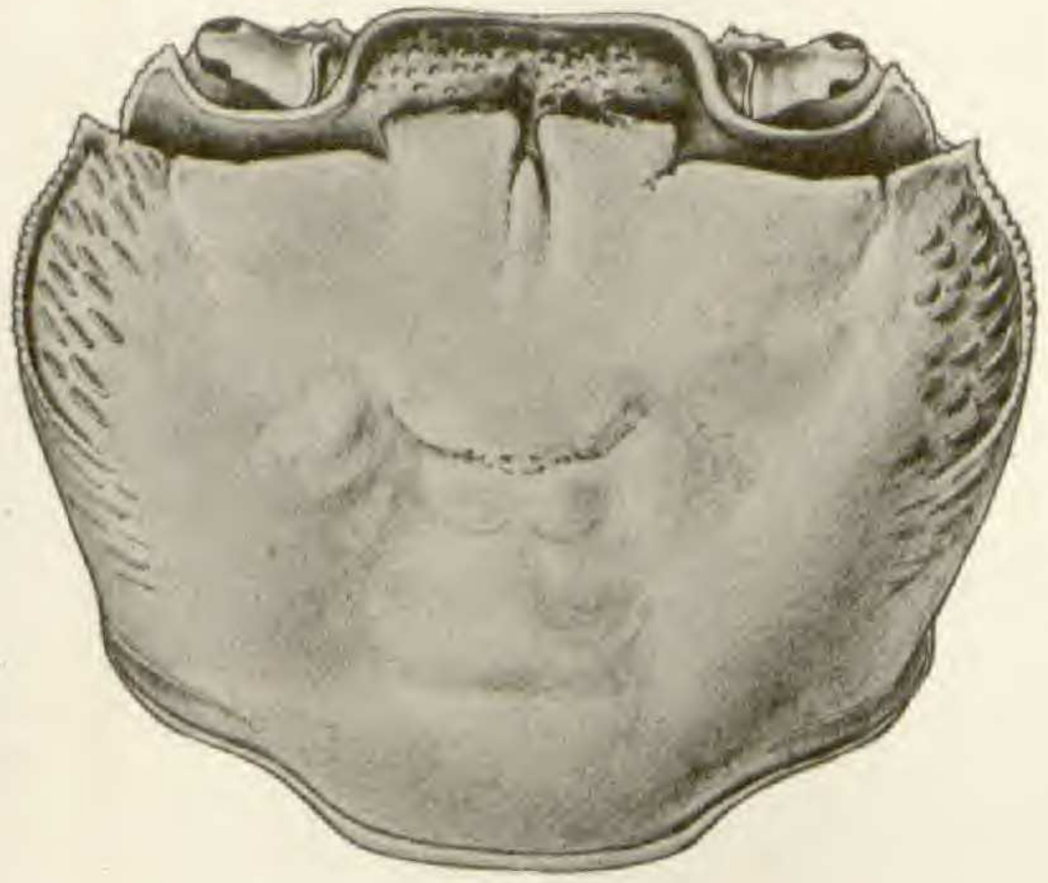

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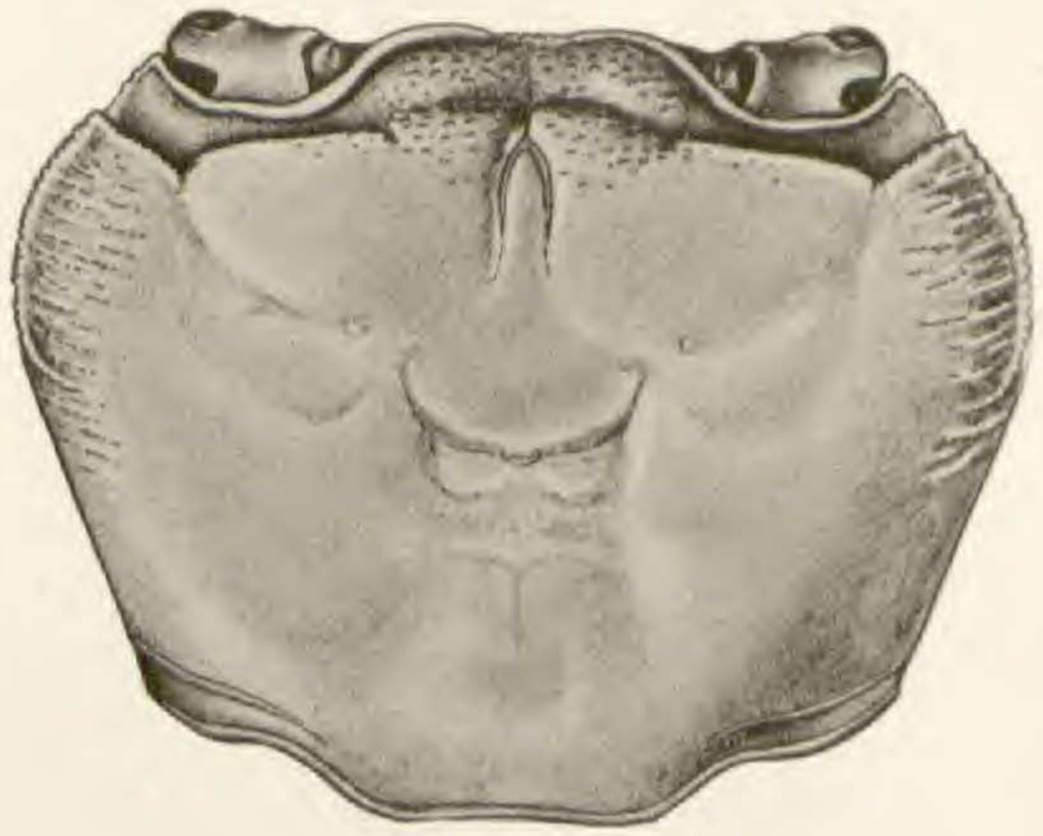

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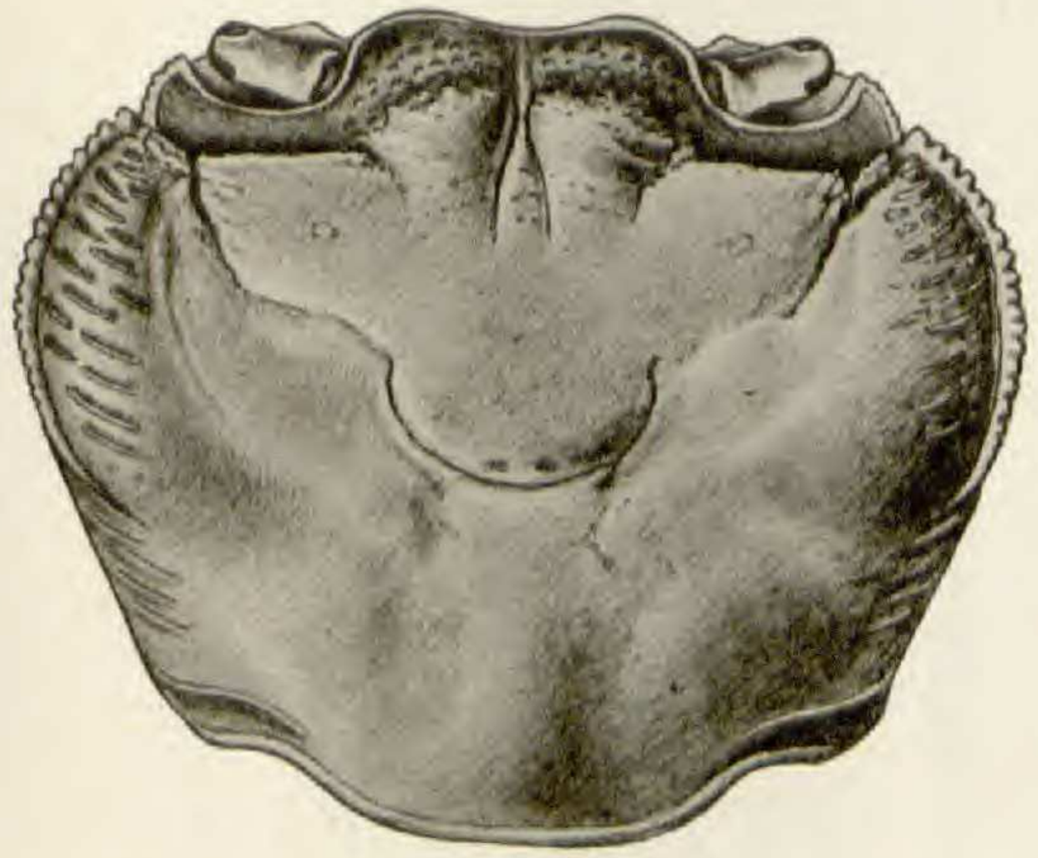

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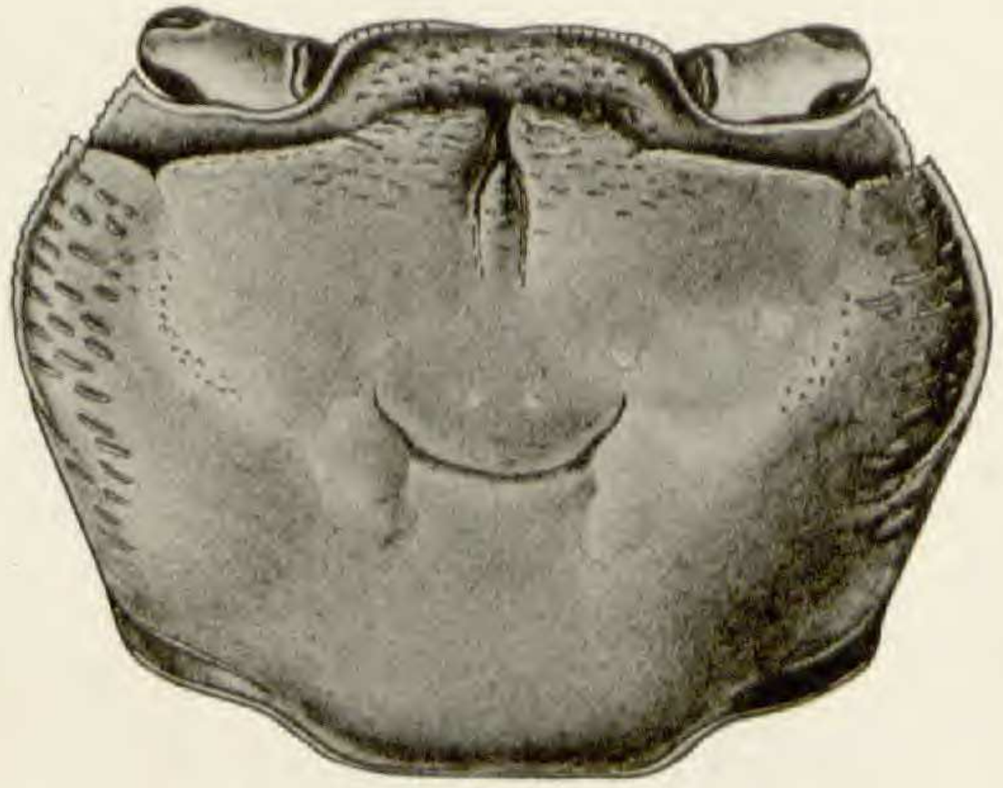

6.

A.C. Chowdhary, del.

Bemrose, Collo., Derby.

CRABS OF THE POTAMON POTAMIOS GROUP.

Plate XIV.